APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC-1997-004

TITLE GUIDE KEEL TRUNNION INTO THE ELEMENT ROTATION STAND (ERS) TRUNNION FIXTURE

DOCUMENT NUMBER/TITLE L5166 CARGO ELEMENT LIFTING ASSEMBLY – O&C/SSPF

PREPARED BY William L. Little

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REQUIRED APPROVAL

CONTRACTOR	____	DESIGN	____	R & QA	X	OPERATIONS	X SAFETY
NASA	____	DESIGN	____	R & QA	X	OPERATIONS	X SAFETY

TYPE OR PRINT NAME	SIGNATURE	ORGN.	DATE
R. Mathews		BD-D4	7-13-98
R. Hicks	Randall L Hicks 7-8-98	F272	7-8-98
W. Dankovchik	Wendy Dankovchik	F670	7-15-98
M. Glenn	M. Glenn	EI-C-A	7/15/98
D. Kyeltal		EI-F-8	7/15/98

CONTRACTOR DIRECTOR OF SAFETY

NASA SUSPENDED LOAD OPERATION
ANALYSIS/APPROVAL

NUMBER: SLO-KSC-1997-004
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OPERATIONS

To guide the Space Station Flight Elements (i.e., Node, Multipurpose Logistics Module (MPLM) with keel trunnion into the Element Rotation Stand (ERS) trunnion fixture located in the Space Station Processing Facility (SSPF).

SUPPORTING DOCUMENTS - The associated operational procedure and System Assurance Analysis (SAA) are as follows:

- OMI L5166, Cargo Element Lifting Assembly - O&C/SSPF
- SAA21CRS1-001, 30 Ton Highbay Bridge Cranes - Space Station Processing Facility (SSPF)

GENERAL DESCRIPTION

Guiding the keel trunnion into the ERS trunnion fixture requires 1 person to be under the suspended payload.

This task is completed in the following OMI sequence:

- OMI L5166, Install Payload into TS (Test Stand), TSF (Trunnion Support Fixture), Canister, or Payload Transporter

During ground processing of the Space Station Flight Elements, it is necessary to transfer the payload into the ERS to perform various operations. During the installation of the payload into the ERS, 1 technician will be required access under the suspended load for the purpose of guiding the keel trunnion into the ERS trunnion fixture.

RATIONALE/ANALYSIS - The suspended load tasks comply with the NASA Alternate Safety Standard as follows:

Alternate Standard Requirement #1a

These operations cannot be conducted without placing personnel under the suspended load. Payload keel trunnion installation into the ERS trunnion fixture requires one technician to work directly under the suspended payload.

Keel trunnion operations at the O&C, OPF, SSPF, and in the payload canister have been evaluated for alternate methods to complete these tasks, and it has been determined that there are no design, operational, or procedural means to eliminate personnel exposure to a suspended load.

During keel trunnion operations, the technician is required to be under the suspended payload to guide the keel trunnion into the ERS trunnion fixture. There is no alternate access to the keel trunnion that is located underneath the payload. This physical limitation precludes any design, operational, or procedural changes that would eliminate personnel exposure to a suspended load.

Alternate Standard Requirement #1b

The possible use of a secondary support system, to catch the load in the event of a crane failure, was analyzed. It was determined that the use of a secondary support system was not feasible because of positioning of the payload over the ERS.

Alternate Standard Requirement #1c

The maximum number of personnel permitted under the suspended load while guiding the keel trunnion into the ERS trunnion fixture is 1.

Alternate Standard Requirement #1d

Guiding the keel trunnion into the ERS trunnion fixture will be accomplished as quickly and safely as possible to minimize exposure time. It will take 1 person a maximum of 30 minutes to guide the keel trunnion into the ERS trunnion fixture.

Alternate Standard Requirement #4

OMI L5166 has been revised to permit only the approved person under the suspended payload. The OMI is available on site for inspection during the operation.

Alternate Standard Requirement #6

The suspended load operations addressed in this analysis involve one of the 30 ton SSPF bridge cranes. The cranes are designed, tested, inspected, maintained, and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9.

The SSPF 30 ton crane hoists are equipped with two magnetic holding brakes, each capable of holding the load up to the crane's rated capacity. Each brake's ability to hold the rated load (30 tons) is verified annually. The cranes are designed to meet a 5 to 1 safety factor based on ultimate strength for the hoist load bearing components. The 30 ton cranes are load tested annually at 100% of their rated capacities. Detailed preventive maintenance is performed monthly, quarterly, semiannually, and annually on the cranes to ensure proper operation. A detailed inspection of the lifting slings is performed annually. Nondestructive testing of the slings and crane hooks is performed annually.

The Cargo Element Lifting Assembly (CELA) is rated at 26,500 lbs. and is designed to meet a 5 to 1 safety factor based on ultimate strength. The combined weight of the CELA, the Space Station Flight element, and miscellaneous hoisting equipment will not exceed 50,000 lbs.

Alternate Standard Requirement #7 - An SAA has been completed on the 30 ton bridge cranes in the SSPF. The SAA includes a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis (see supporting documents). No critical single failure points were identified during this analysis.

Alternate Standard Requirement #8 - Visual inspections for cracks or other signs of damage or anomalies are performed on the hoist hooks, hoist beams, hoist cables, hoist rod assemblies, and hoist fittings, and crane functional checks are performed before each operation per NSS/GO-1740.9.

Alternate Standard Requirement #9 - Trained and licensed crane operators shall remain at the hoist controls while personnel are under the load.

Alternate Standard Requirement #10 - Appropriate safety control areas are established before initiating operations. Only the minimum number of people (manloaded in the procedure) will be permitted in this area.

Alternate Standard Requirement #11 - A pretask briefing and a safety walkdown of the area are conducted prior to the lift to ensure that all systems and personnel are ready to support. All participants are instructed on their specific tasks and warned of any hazards involved. Following any crew change, the new personnel are instructed by the task leader on their specific tasks and warned of any hazards involved.

Alternate Standard Requirement #12 - The person beneath the suspended load will be in voice contact with the hoist operator and/or task leader. Upon loss of communication, the operation shall stop immediately, personnel shall clear the hazardous area, and the load shall be safed. Operations shall not continue until communications are restored.

Alternate Standard Requirement #13 - Personnel working beneath the load shall be in continuous sight of the hoist operator and/or task leader.

APPROVAL: **DATE:** 7/15/98

M. Henn for per telecon, CI-C-A

Joel R. Reynolds
Director, Safety Assurance
Kennedy Space Center